Input indicators relate, for example, to the ability of research systems and research organizations to attract, in competition, external research funding and to recruit recognized researchers and research groups. Structure indicators relate, for example, to indicators of reputation associated with the researchers' status in their network, including membership of editorial boards and international scientific committees. Process indicators relate, for example, to the researchers' participation in conferences and the like. Finally, result indicators relate to output and effect, including publications, citations, patents and contributions to research training in the form of PhD production.

Publication count and citation count result indicators are two of the most fundamental research indicators and ambiguity exists even at these most basic building blocks of Bibliometric assessment. Table 1.2 enumerates a series of theoretical perspectives on the meaning of citation count, throwing light on this ambiguity.

Citation count, for instance, considered an effective indicator, indicates how often publications and therefore, how often researchers are cited by other researchers. Since researchers cite each other for a variety of reasons,[11] what citation counts actually measure is a matter of debate. Garfield[12] enumerates 15 reasons why researchers may cite each other (Table 1.3). In the understanding where researchers cite each other to build on one another's work and results, citation counts are indicative of quality. However, citation behaviour can be argumentative (i.e. selective as support for the researcher's own viewpoint). It can be used to disagree, flatter or show command of a subject area.

It is clear that Bibliometric tools are sensitive to context and interpretation. Not surprisingly a wide range of issues are associated with poor application. Misrepresentations arise, for instance, when comparisons are sought and nuances and variations are neglected. Several index numbers have been developed that can easily be accessed and it can be tempting to make use of these, but unfortunately they are not always used with caution. For instance both publication and citation patterns can be expected to vary considerably between research fields. It is prudent only to compare "like with like". For example, while making a citation analysis related to research achievement at a university, it would be prudent to normalize data by calculating the average number of citations per article relative to the world average for individual research fields to show which subjects have greater or lesser impact than we could expect.

[11] Adler, Robert, Ewing John, and Taylor Peter, (2009). "Citation statistics." Statistical Science 24.1, 1.

[12] Garfield, Eugene, (1965). Can citation indexing be automated, Statistical association methods for mechanized documentation, symposium proceedings.

League tables and ranking systems influence decision making in aspects such as strategy, personnel, recruitment, and public relations.[34] Student decision-making is also impacted by global rankings.[35] Rankings also affect the assessment of institutional reputation by faculty and institutional leaders. In fact, according to Bastedo and Bowman,[36] considering the difficulty in assessing quality parameters and making comparisons between universities (especially those in close competition) over time, the rankings become the reputation, rather than reputations being a parameter in determining rank. The influence of global benchmarking can be noted in various policy reforms in many countries. As noted by Davil Dill,[37] 'the sharp increase in R&D investment among a number of the Nordic countries, the adoption of performance-based funding for academic research, the reforms in doctoral education sweeping across Europe, and the new German Excellence Initiative would be difficult to understand without reference to debates about the relative standing of the world's universities'. Their growing impact holds the danger of creating an ill-motivated prestige-race. While competition and prestige have always been powerful motivators for excellence among higher education institutions, rankings threaten to become a measure for excellence. There is a danger of valuable efforts and resources being diverted to gaining supremacy in Global Rankings replacing the quest for quality with an effort to 'play the ranking game'

Despite all the discrepancies and conceptual issues, it is clear that ranking systems have come to have an influence on most, if not all players in Higher Education. Currently, despite India having the third largest education system, India is conspicuous with its absence among top institutions in international ranking. This may partly be attributed to a disadvantageous representation of Indian institutions and researchers. This underlines the importance to address the data deficit and highlights the importance of a concerted effort in building accurate institutional profiles. With globalization and massification, it is

[34] Hazelkorn, Ellen, (2007). The impact of league tables and ranking systems on higher education decision making. Higher Education Management and Policy 19(2), 87.

[35] UNESCO, UNESCO Forum on Higher Education, Research and Knowledge, (2009). *Occasional Paper* No. 15 - Impact of Global Rankings on Higher Education Research and the Production of Knowledge Ellen Hazelkorn. Available at: *http://unesdoc.unesco.org/images/0018/001816/181653e.pdf* (Accessed on 3-12-2013)

[36] Bastedo, Michael N. and Bowman, Nicholas A., (2011). College rankings as an interorganizational dependency: Establishing the foundation for strategic and institutional accounts. *Res High Educ* 52:3–23 *DOI 10.1007/s11162-010-9185-0.*

[37] Dill, David D., (2006). Convergence and diversity: The role and influence of university rankings. Keynote Address presented at the Consortium of Higher Education Researchers (CHER) *19th Annual Research Conference.* Vol. 9.

selectively, and *ex post,* to provide accountability over the value of investment, are both aimed for in combination. Weaving together the subjectivity of expert (peer) review and quantitative analysis (Bibliometric) has been (Promoting mixed method With sole objectives of aspiring for Excellence, Boosting quality, facilitating Strategic direction, Broadening base, and maintaining quality) the greatest challenge and goal of research assessment systems. These are only few examples of how modern research assessment systems favour mixed models, contextualized, holistic and nuanced approaches. Much contradiction and diversity requires to be addressed by a common system and therefore the parameters, the processes and the implementation is rigorous and feedback as well as flexibility is crucial. The evaluation of 'impact' as a parameter within the model of research assessment has also emerged as an area of research, evaluation and naturally conflict. Defining impact in terms of social, cultural, economic and environmental benefits, has underlined both the criticality of subjectivity in the process as well as the indispensible perspective and contextualization offered by objective methodologies. The global nature of research and the increasing focus on collaboration means that no system can exist in isolation. A successful system must necessarily take this into account and must facilitate

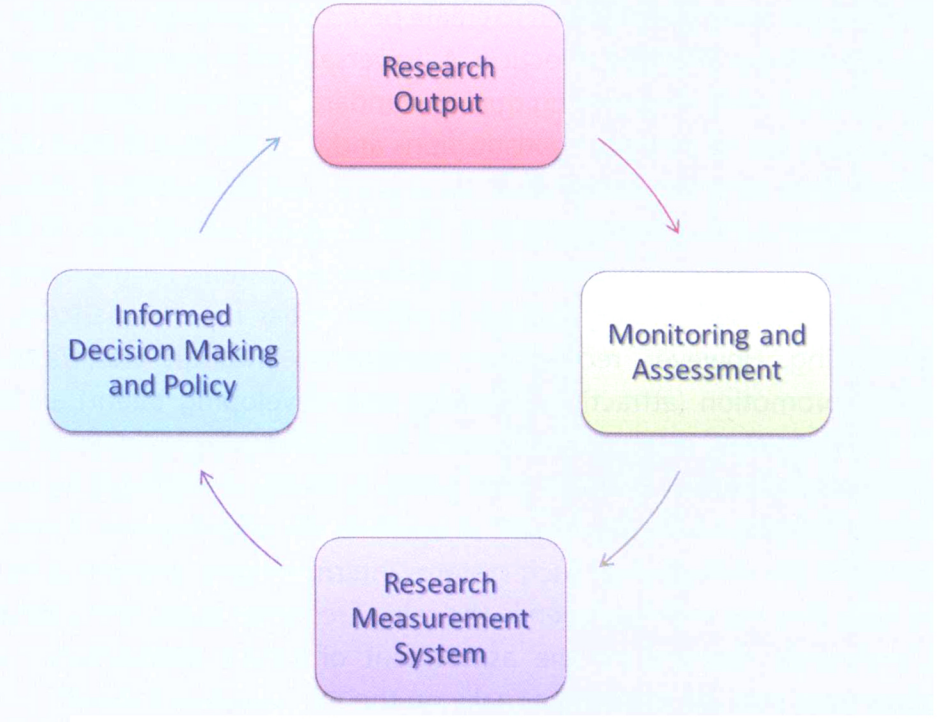

Figure 2.1: *Popularity of 'Mixed Method': Argument for Systemic View of Various Stages*

PART 3: HEALTH OF INDIAN RESEARCH LANDSCAPE

3.3 Monitoring Global Research Landscape

The global research landscape is changing at a fast pace. As a natural consequence, the volume of (scientific) research, measuring to "know something," and recording and communicating that knowledge through publications, has itself become enormous and complex. Science research in the last few decades, evolved as a large enterprise and the substance of scientific research is so complex and specialised that personal knowledge and experience have to be rooted in data and its analysis for understanding trends or for making decisions.[57]

Global competitiveness among the community of Nations in the emerging knowledge economy of the world is often assessed on the basis of the research outputs originating from the country. The global share of publications reflected in the international databases has become one of the major output indicators for assessing the competitiveness of National R&D systems. As such national commitments to strengthen the R&D systems are partly drawn by such research findings.

Increasingly, the health of the research enterprise of various countries is regularly monitored to track the key trends in research productivity and to assess the impact in various subject domains at both national and global levels. Such research assessments require mapping of the research landscape with the aid of scientometric tools. These exercises allow appraisal of competencies/strengths in various domains, the recognition of emerging research trends and early recognition of inadequacies in specific subject domains.

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[57] Pendlebury, David A., (2008). White paper: Using bibliometrics in evaluating research. Thomson Reuters, Philadelphia, USA.